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(54) Valve

(57) A valve comprises a housing (46) of synthetic resin composed of a pipe member (12) and a tubular member (14); a substantially conical closure member main body (23) of synthetic resin having a substantially spherical lower end; and guide grooves of arcuate section matching the curve of the outer peripheral surface of the closure member (23) are formed along the inner peripheral wall of the pipe member (12), while a valve seat part (31) of the pipe member (12) is formed to have the same surface shape as that of the flow passage (39) so as to allow smooth fluid flow without deposition of extraneous matter. The closure member (23) may be coated with a fluoroplastic to reduce friction and may be grooved (Fig. 6) or ridged (Figs. 7–10) at (31) in a direction perpendicular to the flow passage (39).

FIG. 4.

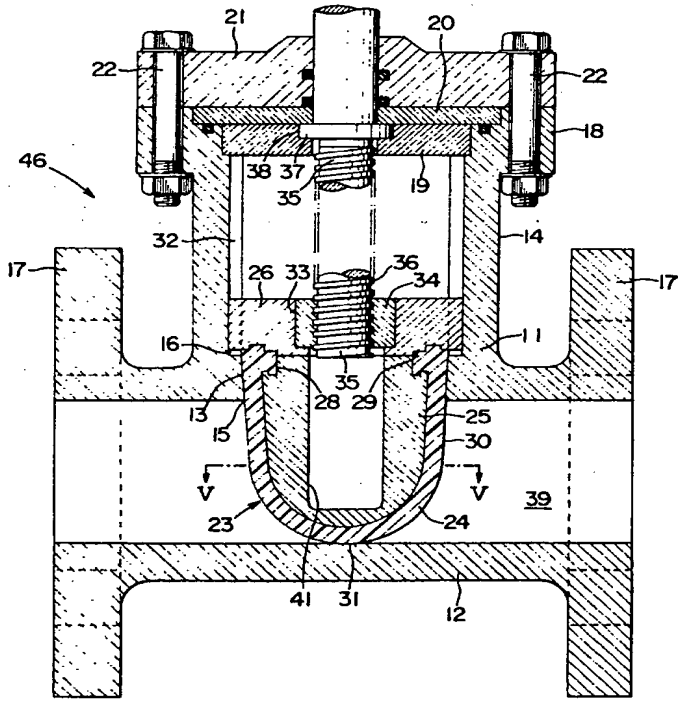

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FIG. 1

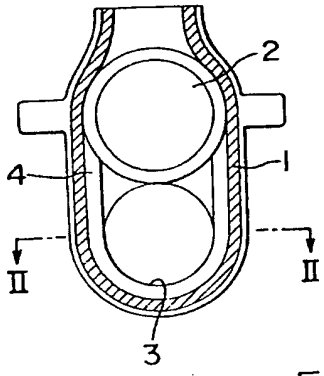
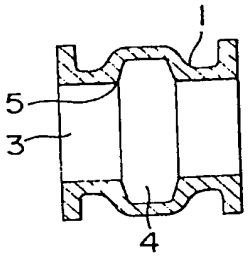


FIG. 3

FIG. 2



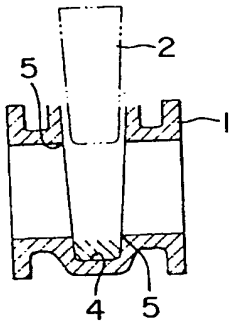


FIG. 5

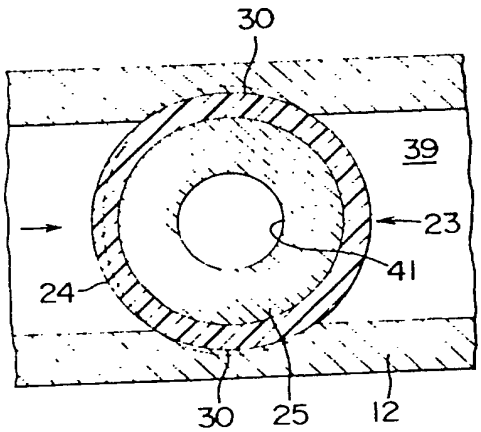


FIG. 6

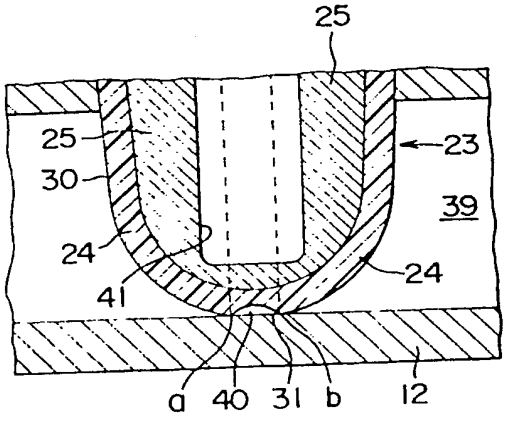


FIG. 4

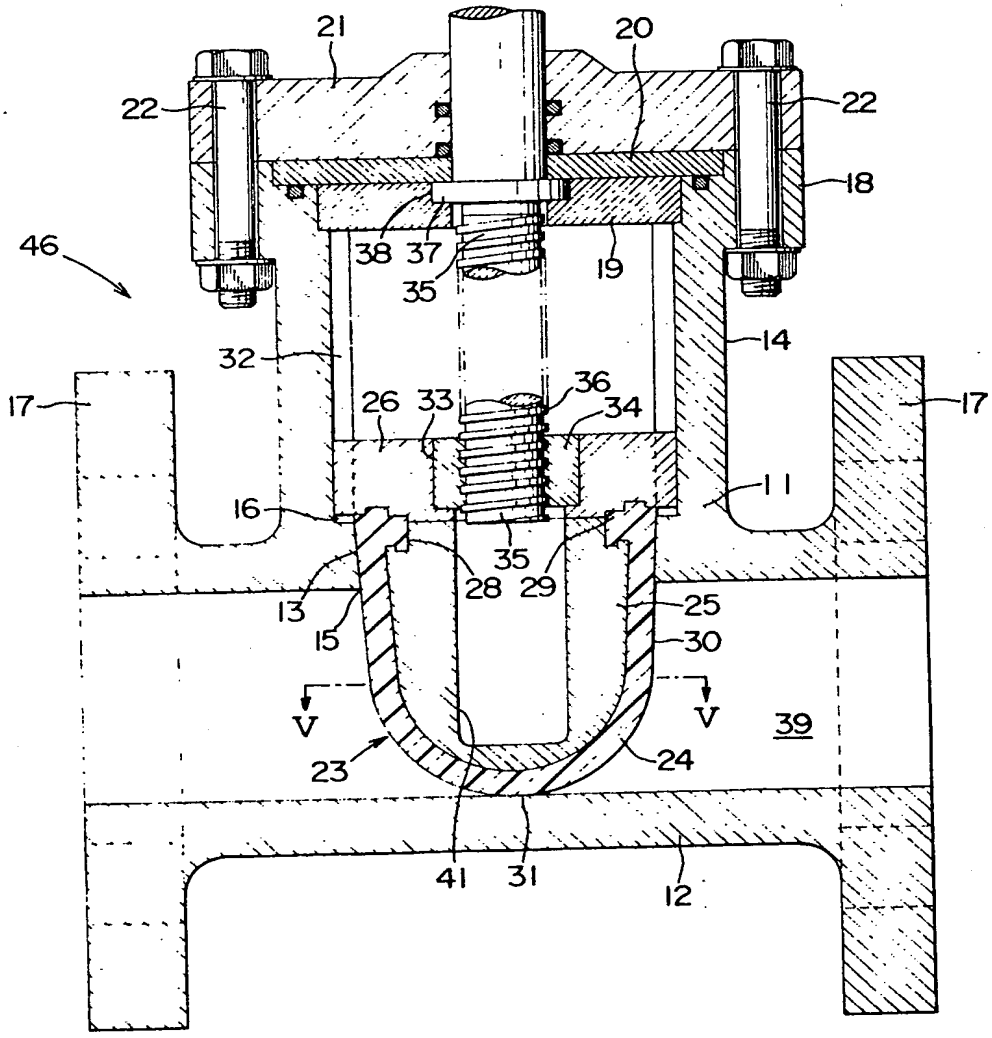

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FIG.7

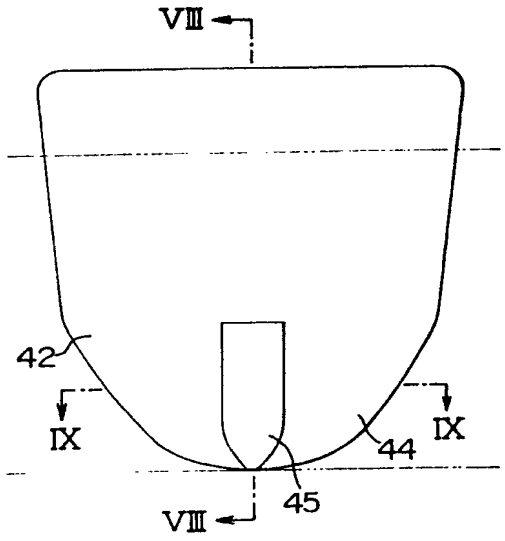


FIG.10

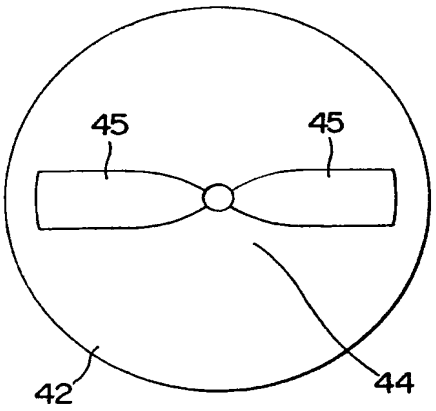


FIG.8

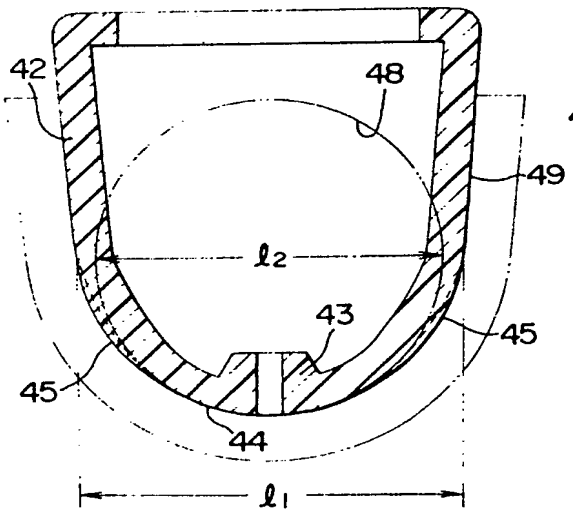
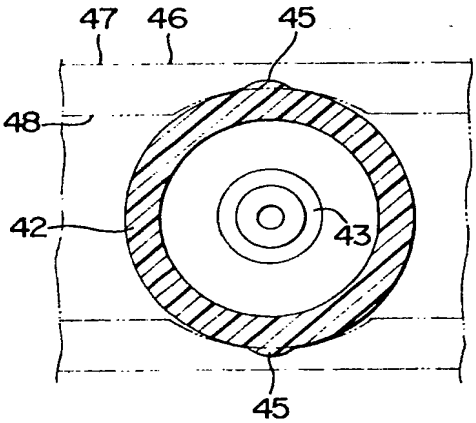


FIG.9



SPECIFICATION

Gate valve apparatus

The present invention concerns a gate valve apparatus and relates to the structure of the valve cage and main body of a valve of a valve apparatus made of synthetic resin and which is used for a water main, for instance.

The following is a description of a conventional gate valve apparatus with reference to Figures 1 to 3. A valve cage (1) and a main body (2) of a valve are made of cast iron. Both can be made relatively thin because they have their own inherent strength. The main body (2) is formed as a flat plate, and it fits into a guide groove (4) which is formed around the side surface of the inner peripheral wall of a flow passage (3) of the valve cage (1) to a lower part thereof so as to prevent vibration of the main body (2) due to the pressure of a fluid. This guide groove (4) formed in the lower part of the flow passage (3), as shown in Figure 3 lets the fluid leak, because dirt deposited in this part prevents the complete closure of the main body (2). Moreover the angular shape of edges (5) of the opening of the guide groove (4) has the faults that it tends to catch extraneous substances the angular part of the edge (5) of the opening of the guide groove (4) is apt to wear by the friction of the fluid, and a gap is formed between the edge and the main body (2) of the valve.

The present invention is designed to solve these faults. The object of the present device is to provide a gate valve apparatus wherein fluid runs smoothly without depositing any dirt in the flow passage of the valve cage and wherein the edge of the opening of the guide groove in the main body of the valve does not wear.

The gate valve apparatus proposed by the present invention comprises a valve cage made of synthetic resin which is composed of a pipe memberconstituting a flow passage and a tubular member protruding upward from a valve seat formed in an opening in the peripheral surface of the pipe member and a substantially conical main valve body made of synthetic resin, which has a substantially spherical lower end, and is inserted from the tubular member into the flow passage of the pipe member through the valve seat so as to open and close the flow passage. Guide grooves with arcuate sections matching the curve of the outer peripheral surface of the main body of the valve are formed in the inner peripheral wall of the pipe member of the valve cage while the valve seat part of the pipe member whereon the substantially spherical end of the main body presses is formed to have the same surface shape as that of the flow passage. Other objects and characteristic features of the present invention will be made apparent hereunder with reference to the drawings.

Figure 1 is a longitudinally sectioned side view of a conventional gate valve apparatus;

Figure 2 is a section taken along the line IIII of Figure 1;

Figure 3 is a longitudinally sectioned front view of the apparatus of Figure 1;

Figure 4 is a longitudinally sectioned front view of one embodiment of the present invention;

Figure 5 is a section taken along the line VV of Figure 4;

Figure 6 is a longitudinally sectioned front view of the lower part of the main valve body of another embodiment of the present invention;

Figure 7 is a front view of an elastic cover body of still another embodiment of the present invention;

Figure 8 is a section taken along the line VIII—VIII of Figure 7;

Figure 9 is a section taken along the line IX—IX of Figure 7; and

Figure 10 is a base view of the elastic cover body of Figure 7.

The constitution of one embodiment of the present invention will be described hereunder with reference to Figures 4 to 6.

Numeral (11) denotes a valve cage made of a synthetic resin such as hard vinyl chloride resin which is provided with a pipe member (12) a valve seat (13), and a tubular member (14). The valve seat (13) has a shape which is reversely tapered and expands upward integrally from the periphery of an opening (15) in the upper part of the inner peripheral surface of the pipe member (12), and the tubular member (14) which acts as a guide, has a shape which protrudes integrally from the outer periphery of the open edge of the valve seat (13) via a circular step (16). Flanges (17) and (18) are formed at both ends of the pipe member (12) and at the upper end of the tubular member (14), respectively. A valve shaft supporting plate (19) is inserted into and engages with an upper opening of the tubular member (14), and a lid body (21) is placed over the valve shaft supporting plate (19) via a thrust supporting plate (20) and is fixed to the flange (18) by bolts (22).

Numeral (23) denotes a main body of the valve which consists of a valve member (25) inserted into the valve seat (13) within anelastic cover body (24), and a guide member (26) fitting over the upper part of the valve member (25) and able to slide within the tubular member (14). The valve member (25) is made of a synthetic resin such as viny chloride resin in a substantially conical shape, with the lower part thereof formed in a spherical shape. A circular step (28) providing engagement is formed around the outer periphery of the upper edge of the valve member (25).

The elastic cover body (24), made of syn-

thetic rubber or the like, which fits tightly into the valve seat (13), covers the whole outer peripheral surface of the valve member (25). A projecting edge (29) providing engagement projects inward in the vicinity of the opening (15) of the valve seat (13) and is formed in a circle around the upper end of the elastic cover body (24), this circular projecting edge (29) engages with the circular engagement step (28) of the valve member (25), and the upper surface of the elastic cover body (24) is pressed down by the guide member (26).

The main body (23) of the valve moves up and down along guide grooves (30) formed on opposite sides of the inner surface of the pipe member (12) of the valve cage (11), and have circular sections matching the curved surfaces of the opposite sides of the outer peripheral surface of the main body (23). A valve seat part (31) of the lower inner part of the pipe member (12) has the same surface shape as that of the inner peripheral surface of this member.

The guide member (26), which engage with guide grooves (32) formed in the tubular member (14) and slides in the vertical direction along the inside of the tubular member (14) fits onto the upper part of the main body (23) protruding into the tubular member (14) and is attached on the upper surface of the valve member (25) by screws or the like. The lower surface of the guide member (26) is fitted under pressure onto the projecting engagement edge (29) formed at the upper end of the elastic cover body (24), to retain the cover body (24).

An internally threaded cylinder (34) is inserted into a shaft hole (33) bored through the center of the upper surface of the guide member (26) into the central part of the main body (23) of the valve, and a thread (36) on a valve shaft (35) is screwed into the internally threaded cylinder (34). The upper part of the valve shaft (35) passes through the valve shaft supporting plate (19), the thrust supporting plate (20) and the lid body (21) in sequence and protrudes above the lid body (21). A circular projection (37) formed at an intermediate part of the valve shaft (35) is held rotatably by a circular recess (38) in the valve shaft supporting plate (19).

A recess (41) into which the valve shaft (35) can be inserted is formed in the valve member (25) of the main body (23) of the valve.

The following is a description of the operations of the embodiment described above.

When the valve shaft (35) is rotated clockwise by a handle (not shown in the figure) starting from the position shown in Figure 4 the main body (23) of the valve moves upward within the tubular member of the valve cage (11) because of the threaded relationship of the internally threaded cylinder (34) and the thread (36), because the axial movement of the shaft (35) is regulated by the interrelation between the valve shaft supporting plate (19) and the thrust supporting plate (20), and because rotation of the main body (23) is regulated by the guide grooves (32). Thus the main body (23) of the valve is separated from the valve seat part (31) and the flow passage (39) of the pipe member (12) is opened.

When the valve shaft (35) is rotated counterclockwise, starting from this open position, the main body (23) of the valve moves downward within the pipe member (12) by the opposite operation to the above to seal the valve seat part (31) and the flow passage (39) of the pipe member (12) and thus the flow passage (39) is fully closed. In this state, the elastic cover body (24) fits tightly into the valve seat part (31) and the guide grooves (30) preventing any leakage of fluid. The lower part of the flow passage (39) of the pipe member (12) which has the same surface shape as that of the flow passage (39) and has no indentation therein prevents any deposition of dirt in the flow passage (39) and the circular guide grooves (30) of the pipe member (12) have no angular parts which would catch extraneous substances, and thus is free from wear due to the fluid.

In addition, the substantially spherical end of the valve member (25) of the main body (23) of the valve provides little resistance to the fluid, even when the main body is at an intermediate position when half-open.

The following is a description of another embodiment of this inventions, with reference to Figure 6.

This embodiment has a structure wherein a groove (40) is formed in the lower end of the elastic cover body (24) of the main body (23) of the valve in the direction perpendicular to the flow passage (39). This structure makes the elastic cover body (24) contact the valve seat part (31) at two places (a) and (b), at either side of the concave groove (40) which enables a surer prevention of leakage of fluid.

The structure of still another embodiment of the present invention will be described hereunder with reference to Figures 7 to 10. In this embodiment, a projection (43) which projects inward as a thickened wall into a recess formed at the lower end of the valve body is formed at the lower end of the elastic cover body (42) made of synthetic rubber or the like and which covers the valve body to prevent the valve body and the elastic cover body (42) sliding mutually during the opening/ closing operations of the main body of the valve or by the water pressure. Projecting ridges (45) are also formed opposite to each other in the axial direction on the outer periphery of a hemispherical surface (44) at the lower part of the elastic cover body (42), and the lower ends of each of the projecting ridges (45) are of the same surface shape as that of the lower end

of the elastic cover body (42). The outer surface of the elastic cover body (42) is coated with a fluoroplastic to provide a smooth motion thereof.

The diameter l_1 of the hemispherical part of the main body of the valve, which comprises the valve body and the elastic cover body (42) fitted over the valve body, is made larger than the diameter l_2 of a pipe member (47) of a valve cage (46), and concave grooves (49) of a larger size than the diameter l_2 of the pipe member (47) are formed opposite to each other in the direction perpendicular to the axial direction, at the position of the valve seat in a flow passage (48) constituted by the inner walls of the pipe member (47). The main body (23) is made to touch the inside of the concave grooves (49) so that the projecting ridges (45) of the elastic cover body (42) are positioned atthe lateral centers of the concave grooves (49). The elastic cover body (42) is formed to a larger size than that of the concave grooves (49) at the position of the projecting ridges (45).

In this structure, the main body (23) of the valve is pressed strongly and linearly into the concave grooves (49) of the flow passage (48) at the positions of the projecting ridges (45). The increase in pressure per unit area thus obtained has the effect of stopping the water with a lower fastening torque. In addition the fluoroplastic coating formed over the outer surface of the elastic cover body (42) reduces the friction of the body against the valve seat and the concave grooves (49), and enables a reduction in the fastening torque. Accordingly, no excess force is applied to the elastic cover body (42), and thus the durability thereof is increased.

According to the present invention, the valve seat part in the lower part of the pipe member of the valve cage has no indentation forming a pocket, and has the same surface shape as that of the flow passage of the pipe member. Therefore, the deposition of dirt, etc., in the pipe member is prevented, and thus the flow passage can be closed without error. Moreover the arcuate guide grooves formed in the pipe member have arcuate sections matching the curved surface of the main body of the valve. Therefore no extraneous substances are caught by the edges of the guide grooves and these edges are not worn much by the fluid. The substantially spherical end of the main body of the valve makes the fluid run smoothly even when it is at an intermediate position (a half-open position). The main body of the valve has a substantially conical shape. Therefore when fluid pressure is applied from the direction of the arrow in Figure 5 the peripheral surface thereof subjected to the fluid pressure is pushed inward but the peripheral surfaces on either side of this surface, which are perpendicular thereto, expand to change their shape to that shown by the broken lines. Thus, the peripheral surfaces on either side of the main body of the valve fit firmly and closely into the guide grooves, so that the sealing property of the body can be increased. In addition, the substantially conical shape of the main body of the valve facilitates turning when manufacturing the mold therefor, and the valve cage and the main body of the valve of synthetic resin are light weight and have a superior corrosion resistance.

CLAIMS

1. A gate valve apparatus characterized in that it comprises a valve cage made of synthetic resin which is composed of a pipe member constituting a flow passage and a tubular member protruding upward from a valve seat formed in an opening in the peripheral surface of said pipe member; and a substantially conical main body of a valve made of synthetic resin which has a substantially spherical lower end and is inserted from said tubular member into said flow passage of said pipe member through said valve seat so as to open and close said flow passage; and guide grooves of arcuate section matching the curve of the outer peripheral surface of said main body of said valve are formed along the inner peripheral wall of said pipe member of said valve cage; while a valve seat part of said pipe member onto which the substantially spherical end of said main body of the valve presses is formed to have the same surface shape as that of said flow passage.

2. Gate valve apparatus, substantially as hereinbefore described with reference to the accompanying drawings.

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